Glenn T. Seaborg Center Seminar

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Application of X-ray Absorption Spectroscopy (XAS) to the Radioactive Elements

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4 pm
Building 70A-3377

Two examples of the use of XAS in our work on the radioactive elements will be discussed. The first is its application to the study of model geochemical systems, focusing here specifically on the reactions of mackinawite (FeS) with Tc, U and Np. Mackinawite is an important phase in reducing, near-surface environments since it is the first crystalline Fe-S phase formed at low temperatures and is a key intermediate in the formation of more stable phases such as pyrite or marcasite. Mackinawite is poorly crystalline with a highly reactive surface, so its reactions with redox-sensitive radioactive species may both control their environmental mobility and have applications in effluent treatment. XAS, coupled with computational chemistry, has been used to define the outcome of these interactions.

Second, both low- and high-temperature molten salts are being investigated as alternative media for nuclear fuel reprocessing. We have developed techniques for *in situ* UV-visible-near IR spectroscopy in high temperature (400-800ºC) melts and have explored the chemistry of Tc and Re in these media. Tc volatility is strongly influenced by conditions in the melt and EXAFS spectroscopy of the quenched melts has been used to identify the Tc species formed. The high temperature *in situ* spectroscopy techniques have also been adapted for use on a synchrotron beamline and used to study the chemistry of U(III), U(IV), U(V) and U(VI) in these melts. A range of complexes has been identified, including both monomeric and polymeric species.

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